

## SECTION III

### PART P POLICIES FOR CONSTRUCTION PROJECTS ADMINISTRATION

#### **1.00 Statutory Authority**

- 1.01 The 1985 Higher Education Reorganization Act (HB 1187) invests with the Commission the responsibility of assuring that capital construction projects are implemented in accord with approved physical plans that conform with CCHE approved program plans.

23-1-106(3) C.R.S. requires that "no capital construction shall commence except in accord with an approved master plan, program plan, and physical plan."

- 1.02 The 1987 State Appropriations Act (SB 218, subsection 6 of the Capital Construction Appropriations) directs the Commission to assure the legislature that appropriated construction projects whose lowest bid is in excess of the appropriations will be redesigned to (a) conform to the appropriation, (b) will meet the program needs of the agency, and (c) the necessary quality of the building. CCHE is to regularly report all such analyses to the Joint Budget Committee and to the Capital Development Committee. Redesigned projects not approved by CCHE are stopped until reauthorized by the legislature.

#### **2.00 State Construction Planning and Management**

- 2.01 Governing boards shall formally designate administrative, legal and fiscal accountability for construction projects management and reporting.

- 2.02 Governing boards shall regularly report to the Commission on the status of each authorized capital construction or controlled maintenance project, from physical plans review through construction bidding results, as to consistency with

- state appropriation
- program needs of the agency
- necessary quality of the building

- 2.03 Governing boards shall establish and maintain a physical planning review process by a second party qualified through professional registration or certification, and independent of the principal representative, to review and to certify to the governing board, the Colorado Commission on Higher Education, and State Buildings Division the schematic design, design development, and construction documents as to

- correlation of spaces with approved CCHE program plan;
- analysis of the structure as it relates to the current Uniform Building Code;

-- construction cost estimates;

as provided for in Section 4.00; all project files to be subject to state audit.

### **3.00 Review and Approval**

- 3.01 A construction project whose lowest bid is in excess of the appropriation shall be redesigned to conform to the appropriation and may be commenced if approved by the Colorado Commission on Higher Education under the provisions set forth in subsection 6 of the Capital Construction Appropriations Section of the FY 1987-88 State Appropriations Act.
- 3.02 The governing board shall submit redesigned projects to the Commission for approval, and the Commission shall assure that the redesigned project is consistent with the state appropriation, meets the program needs of the agency, and the necessary quality of the building. If the redesigned project is not approved, it shall not be commenced until further action is taken by the General Assembly to reauthorize the project.
- 3.03 The Commission shall report all such analyses to the legislative Joint Budget Committee and to the Capital Development Committee on a regular basis.

### **4.00**

#### **COLORADO COMMISSION ON HIGHER EDUCATION AND COLORADO DEPARTMENT OF ADMINISTRATION STATE BUILDINGS DIVISION**

#### **REQUIREMENTS FOR ARCHITECT/ENGINEER PLAN, SPECIFICATION, OR REPORT REVIEW**

##### **A. SCHEMATIC DESIGN PHASE**

1. After executing the Architectural Professional Services Agreement, the Architect shall develop the schematic concept data presented in the Building Program or Educational Program Specifications, and as authorized by the State Legislature "Long Bill" Appropriation.
2. Objectives
  - To determine understanding of the building program.
  - To determine possible solutions at minimum design expense.
  - To provide a diagrammatic statement of the program illustrating the program requirements.
  - To set forth the options available to the Principal Representative with regards to contracting procedures, bidding packages and methods for accomplishing the work.
  - To assist the Principal Representative in determining the feasibility of the project.

- To select from a list of architectural, mechanical and electrical design/systems, the most effective design/systems for the specific application, and Section 3 Building Standards/Plan Review.

The following items correlate with requirements of the State of Colorado Architects and Engineers Agreement, Article 3, paragraph 2, Development of the Project.

(a) Correlation of Spaces with Approved State Standards

The approved program developed by the college, institution or agency for a given facility is based upon facilities master planning criteria. This data is generated from head count, contact hours, area per student station, assignable areas, nonassignable areas, gross area, building efficiency ratios and other planning factors.

The Schematic Design Phase will, in some cases, vary from the program data and the Architect/Engineer is to show the correlation of spaces developed in the program as compared to Schematic Design.

In the case of a project that is not a building, a utility project, for instance, would not be concerned with space standards.

(b) Recommended Site Location

Engineering Subsurface Investigation Report

Engineering Subsurface Investigation Report shall furnish data and information of subsurface soil, water and other conditions which will have an influence on project design. It will also include recommendations for foundation design and finished grading. The subsurface investigation shall be performed in close cooperation with the project Architect and the structural engineer.

General outline of the suggested scope of subsurface investigation:

The borings or test pits shall extend into stable soils well below the bottom of any proposed foundation. A field log of the borings shall be made and the thickness, consistency and character of each layer recorded.

The amount and elevation of ground water encountered in each pit or boring and its probable variation with the seasons and the effect on the subsoils shall be determined. High and low water levels of nearby bodies of water affecting the ground level shall also be determined.

Appropriate laboratory tests shall be performed to determine the safe bearing and compressibility characteristics of the various strata encountered in each pit or boring.

Maximum depth of frost penetration below surface of the ground shall be recorded.

Tests shall be made to determine whether the soil contains alkali in sufficient quantities to affect concrete foundations.

Corrosives tests shall be made to determine whether the soil will adversely affect underground metallic conduits.

If the site is underlaid with mines, or if old workings are located in the vicinity, the elevation and location of the top of such workings shall be determined.

Where the Architect certifies that an existing subsurface soil data report is satisfactory for additions or alterations to an existing structure, a new soil report will not be required.

Relationship diagrams showing the major program areas and site elements and relationship of spaces within the major program areas.

Single-line circulation diagrams showing the movement and activities of staff, students, custodial and visitors; the movement systems of material and supplies, and vehicular circulation as applicable.

(c) Scope of Site Development

The Site Survey Drawings shall show:

The courses and distances of property lines of all parcels which comprise the project site.

Details of existing party walls, or walls and foundations adjacent to lot lines.

The positions, dimensions, and elevations of all existing excavations, wells, back-filled areas, and existing openings, and the elevation of any water therein.

All trees which may be affected by the building operations.

Detailed information relative to established curb and building lines and street, alley, sidewalk and curb grades at or adjacent to the site, and the materials of which they are constructed.

Floor elevations for all existing buildings which are to be modernized or to which additions will be constructed.

All utility services including pipe sizes, pressures, and electrical characteristics.

The location and invert elevations of all piping, mains, sewers, poles, wires, hydrants, and manholes, upon, over, or under the site, or adjacent to the site, if within the limits of the survey.

Data upon which elevations are based and a bench mark established on or adjacent to the site. Contour lines at not less than 5'0" intervals. Also for projects subject to a flood hazard indicate the first floor elevation in relation to the elevation of the flood plain.

Certification on the survey drawing by the city or county engineer or other qualified officials that the officially established street lines, grades of curbs, sidewalks and sewers are correctly shown.

#### Site Plan

The Site Plan shall indicate the proposed location of the building(s) on the property site; property site dimensions; and all proposed site improvements such as walks, roads, and parking areas. The extent of project site improvements shall be indicated by a work limitation line.

Consideration shall be given to the most advantageous siting of the building in regard to solar gain or heat loss. Solar studies for the shading of windows, walls, equinox extremes, afternoon heat, prevailing winds or other climate factors may be necessary depending upon the kind of facility and its long-range use.

#### (d) Analysis of the Structure as it Relates to the Uniform Building Code

The following procedure may be helpful in using the Uniform Building Code:

1. Classify the building:
  - A. OCCUPANCY GROUP: Determine the occupancy group which the use of the building most nearly resembles. See the '01 sections of Chapters 5 through 12. See Section 503 for buildings with mixed occupancies.
  - B. TYPE OF CONSTRUCTION: Determine the type of construction of the building by the building materials used and the fire resistance of the parts of the building. See Chapters 17 through 22.

- C. LOCATION ON PROPERTY: Determine the location of the building on the site clearances to property lines and other buildings from the plot plan. See Table No. 5-A and '03 sections of Chapters 18 through 22 for exterior wall and wall opening requirements based on proximity to property lines. See 504 for buildings located on the same site.
  - D. FLOOR AREA: Compute the floor area of the building. See Table No. 5-C for basic allowable floor area based on occupancy group and type of construction. See Section 506 for allowable increases based on location on property and installation of an approved automatic fire-sprinkler system. See Section 505 (b) for allowable floor area of multistory buildings.
  - E. HEIGHT AND NUMBER OF STORIES: Compute the height of the building, Section 409, from grade. Section 408, and for the number of stories. Section 420. See Table No. 5-D for the allowable height and number of stories based on occupancy group and type of construction. See Section 507 for allowable story increase based on the installation of an approved automatic fire-sprinkler system.
  - F. OCCUPANT LOAD: Compute the occupant load of the building. See Section 3302 and Table No. 33-A.
- 2. Verify compliance of the building with detailed occupancy requirements. See Chapters 6 through 12.
  - 3. Verify compliance of the building with detailed type of construction requirements. See Chapters 17 through 22.
  - 4. Verify compliance of the building with exit requirements. See Chapter 33.
  - 5. Verify compliance of the building with detailed code regulations. See Chapters 29 through 43, Chapters 47 through 54, and Appendix.
  - 6. Verify compliance of building with engineering regulations and requirements for materials of construction. See Chapters 23 through 29.
- (e) Sketch Floor Plans, Elevations and Sections

Floor Plans

Prepare small scale drawings of buildings to show all rooms and areas including exits, stairways, elevators, circulation corridors and halls, toilet rooms, stacks and mechanical and electrical equipment areas.

Such items as compartmentation of the building(s) to inhibit fire and smoke penetration into adjacent areas, door swings and corridor widths to insure proper evacuation of the building in case of fire, and the required enclosure of stairways and hazardous areas shall be indicated on the plans.

Overall exterior dimensions of the building(s) shall be shown. Future expansions shall be indicated by dotted lines and identified by the wording "future expansion."

The plan should also show the provisions for making the building(s) accessible to the physically handicapped such as ramps at curbs and entrances for wheelchairs and parking spaces reserved for the handicapped.

#### Elevation Drawings

Prepare small scale elevation drawings to show by block outline and breaks, the various building masses and how they coincide with the floor plans. Typical fenestration arrangements, door locations, and exterior facing materials shall be shown only to the extent necessary to indicate exterior design elements and features. Floor-to-floor dimensions shall be shown with future expansions noted by dotted lines. Particular attention should be given to ramps and other accesses to the building(s) for the use of physically handicapped persons.

#### Sections

Prepare small scale outline sections as may be required to illustrate typical clearances, voids or atriums within the building, theatre or lecture room sight lines, or differences in grade that need be illustrated to comprehend the plan three-dimensionally.

- (f) Sketches and Descriptions of Building Plumbing, Mechanical and Electrical Systems

Provide sketches, descriptions and "costing methodology" which will indicate the various building electrical, plumbing and mechanical systems selected, including their special characteristics together with an economic analysis which affected the choice and coordination of all systems.

#### Conceptual Design

A conceptual design analysis is a study to determine the effects of various architectural designs on the mechanical/electrical systems. The objective of this analysis is to evaluate the trade-off between the architectural/mechanical/electrical systems and to avoid, where possible,

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designing into the facility any characteristics which adversely affect other systems. The Architect/Engineer should establish the architectural/mechanical/electrical systems which will be further evaluated in the schematic design analysis. Energy conservation systems and techniques should also be established.

It may be desirable to request a conceptual design review early in the schematic design phase to review the project plan and schedule, and to establish agreement on the approach being taken by the Architect/Engineer. At such a review the following items would be evaluated:

- (1) Architectural - Design and Layout
- (2) Mechanical
- (3) Electrical
- (4) Energy Conservation

The Evaluation Criteria - to determine if the initial cost is the most important factor or if the energy consumption and operational cost is to equally considered.

The interrelationships between the architectural design and the mechanical and electrical systems to determine if any aspects of the architectural design will adversely affect the mechanical or electrical systems.

The Architect/Engineer should analyze the architectural, mechanical, electrical and energy conservation systems utilizing value engineering and life cycle costing techniques. This analysis should evaluate the technical and economic factors involved and include such items as:

- a. Initial Cost
- b. Energy Consumption and Related Cost
- c. Operational and Maintenance Cost  
Repair and Replacement Cost
- d. Financing Cost - if appropriate

The energy consumption for systems should be calculated for each year during the life cycle period. The cost associated with this energy consumption should be based on local utility rates and should be escalated at some rate which is consistent with the utility company's predictions, over the life cycle period. If the size and complexity warrant it, the Architect/Engineer should consider using one of the available energy analysis and economic trade-offs for the systems and techniques. The energy analysis for the various systems should take into account such items as:

- a. Building description - architectural features, construction, content, etc.
- b. Weather data - for a typical year.



- c. Systems descriptions - a definition of the system types such as double duct, economizer cycle, constant volume, reheat, etc.
- d. Equipment description - this should include the full and part load performance characteristics of the equipment, such as boilers, chillers, air handlers, etc.
- e. Economic data - such as first cost, operational cost, maintenance cost, financing cost, etc.

(g) Area Computations

Provide gross square foot areas, net square foot areas and volume calculations. Where multi-floored projects are involved, each floor shall be shown separately and a total given for the project.

(h) Outline of Proposed Construction Materials

Schematic outline specifications using CSI Format shall consist of a general description of the foundation, structural, plumbing, heating ventilating, cooling and electrical systems, and interior/exterior material finishes with the proposed flame spread rating of all applicable finishes.

(i) Preliminary Timetable for Design Development

Project Development Schedule

This schedule will indicate by month and year, when it is planned that both design development and construction documents will be completed; the project will be bid; the project will be placed under construction; and construction will be completed. When Construction Management services are to be used, the separate bid packages shall be identified, scheduled and integrated with the design development schedule.

(j) Architect/Engineers Estimate of Construction Cost

Preliminary statement using CSI Format of probable construction costs.

Current Construction Cost Estimate

The construction cost estimate at the Schematic state shall consist of a breakdown of the total construction cost estimate by building, installed or fixed equipment, site improvements, and exterior utilities.

B. DESIGN DEVELOPMENT PHASE

Purpose

The general purpose of the Design Development Phase is to fix and describe the size and character of the entire project and such other essentials as may be appropriate. The Design

Development Documents are prepared from the approved Schematic Design studies and when approved will form the basis for the Construction Documents.

- (a) Outline Concepts of the Proposed Structural, Mechanical and Electrical Systems
- (b) Respective Floor Plans
- (c) Elevations

#### Architectural Drawings

Plans of basement, floors and roof showing space assignments, size, location of installed or fixed equipment (for health facilities bed capacities will be shown by floor) elevations and typical building and wall sections. Such items as compartmentation of the buildings to inhibit fire and smoke penetration into adjacent areas, door swings and corridor widths to insure proper evacuation of the building in case of fire, and the required enclosure of stairwells and elevator shafts shall be indicated on the preliminary drawings.

Assembly ratings as specified by the Underwriter's Laboratories, Inc., or other nationally recognized testing laboratories, shall be indicated on the Design Development drawings for all items requiring such a rating.

The requirements for making facilities accessible to and usable by the physically handicapped shall be shown at the Design Development stage for conformance with CRS 9-5-102 revised 1976.

Architectural drawings shall also include:

Site plan showing roads, parking, exterior utilities, sidewalks and other site improvements.

#### Mechanical Drawings

Single line layouts of all duct and piping systems and location and layout of boiler and major associated equipment and central heating, cooling and ventilating units. All fire dampers, smoke dampers, and other fire safety items. Riser diagrams for multistory construction. In sizing the mechanical systems such as air conditioning equipment, boilers, etc., the Architect/Engineer should consider the annual load profile as well as the peak load demand. It may be cost effective to size modular units to satisfy the peak load demand and at the same time maximize the operating efficiency at the lower load levels experienced at other seasons of the year. An economic analysis should be done to determine if this is cost effective.

#### Electrical Drawings

Plans showing space assignments, sizes and outline of fixed equipment such as transformers, main switchgear, switchboards and generator sets. Simple riser diagrams for multistory construction showing arrangements of feeders, subfeeders,

bus work, load centers and branch circuit panels. All fire detector locations, exit and emergency lights and fire alarms required.

### Structural Drawings

Plans, elevations and cross sections shall be of sufficient clarity to show the extent of the work and type of framing. Adequate details and notes shall be provided to show that the structure will conform to the provisions of applicable building codes and the soils data report.

(d) Proposed Finish Schedule

(e) Outline Specifications

Outline Specifications for Design Development Drawings - Specifications for this stage shall include:

- a. General description of the construction, including interior finishes, types and locations of acoustical material and special floor coverings.
- b. Description of the air conditioning, heating and ventilation systems, including controls, ducts and piping. (For health facility projects this shall include surgical, dietary, laundry, sterilizing and other special equipment areas.)
- c. General description of electrical services, including voltage, number of feeders, and whether feeders are overhead or underground. Provide specific description of items to be served by emergency power. Describe design considerations for special areas, such as anesthetizing locations.
- d. All fire safety items shown on the Design Development drawings shall be described in the outline specifications. This shall include the flame spread rating of all applicable material finishes.

### Equipment

Built-in Equipment: There are two types of built-in (fixed) equipment to be considered in Design Development. These are:

a. Built-In Building Service System Equipment

All equipment and machinery which is normally a part of the construction and which is necessary for the effective functioning of the building or uniformly distributed through all portions of the building such as heating, ventilating, air conditioning, vertical transportation, public address, and communication systems.

b. Other Built-In Equipment

All items of equipment which are permanently fastened to the building or the grounds and which are required for the program function of the building.

#### Movable Equipment

Movable Equipment is defined as those items which are normally placed in the building after construction is completed and which function as furnishings, decorations and specialty equipment and which are not permanently fixed to the structure. Movable Equipment shall not be included in the construction contract.

(f) A Timetable for the Completion of the Construction Documents

(g) Estimate of Construction Costs

#### Current Construction Cost Estimate

Estimate shall be based on Design Development drawings and in a similar format to that specified for submittal with the Schematic Design Documents.

(h) Estimate of Time Required for the Construction of the Project

### C. CONSTRUCTION DOCUMENT PHASE

#### Final Working Drawings

Final Working Drawings shall be complete and adequate for bid, contract and construction purposes. Drawings shall be prepared for the architectural, structural, mechanical, electrical and other construction portions of the work.

#### Final Technical Specifications

Final Technical Specifications shall supplement the final working drawings to fully describe types, sizes, capacities, workmanship, finishes, and other characteristics of all materials and equipment. The Technical Specifications format shall use C.S.I. format.

Specifications shall be developed to ensure competitive bidding without proprietary sole-source restrictions. When it is necessary to identify a material or equipment by manufacturer's name, trade name, or catalogue number, it is preferable to identify it by a single manufacturer's name or trade name. This method of developing specifications is not meant to give preference to any one manufacturer, but is merely to establish a standard, and under the conditions of the contract, the contractor shall be allowed to furnish material or equipment of manufacturers other than those identified by name which are acceptable to the project Architect/Engineer as being comparable to that specified.

#### Report Format

Specifications, charts, tables and other data to supplement drawings shall be bound in standard 8 1/2" x 11" sizes. If drawings or charts are larger than 8 1/2" x 11", they shall be designed to fold within the 8 1/2" x 11" format.

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